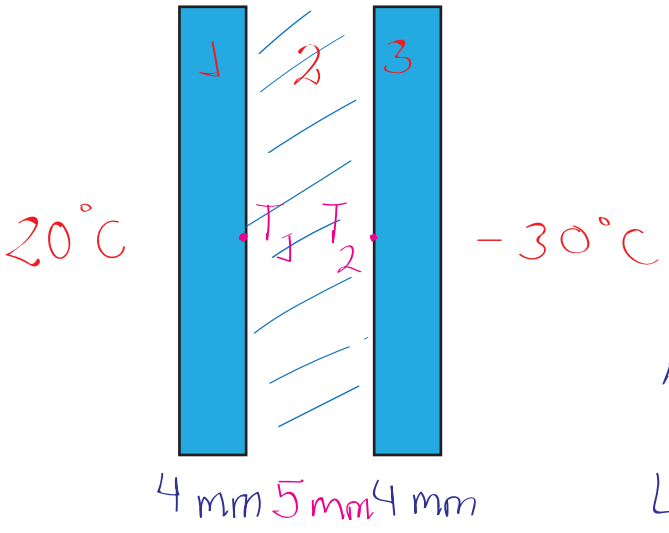
96. Una ventana térmica, con área de 6.00 m^2, se construye de dos capas de vidrio, cada una de 4.00 mm de grosor, separadas una de otra por un espacio de aire de 5.00 mm. Si la superficie interior está a 20.0°C y la exterior a -30.0°C, ¿cuál es la rapidez de transferencia de energía por conducción a través de la ventana?



$A_1 = A_2 = A_3 = A$

$L_1 = L_3 = 4m$; $L_2 = 5$ mm

Sabemos

$$H_1 = H_2 = H_3$$

Si $H_1 = H_2$ $\quad T_1 > T_2$

$$K_V \frac{A}{L_1}(20 - T_1) = K_A \frac{A}{L_2}(T_1 - T_2)$$

$$\frac{K_V}{K_A}\frac{L_2}{L_1}(20 - T_1) = T_1 - T_2$$

α

$$\alpha(20 - T_1) = T_1 - T_2$$

$$20\alpha - T_1\alpha = T_1 - T_2$$

$$20\alpha + T_2 = T_1 + T_1\alpha$$

$$T_1(\alpha+1) = 20\alpha + T_2$$

$$T_1(\alpha+1) - 20\alpha = T_2 \quad \ldots \text{ ec } 1$$

Si $H_1 = H_3$

$$\cancel{K_V}\ \frac{\cancel{A}}{\cancel{L_1}}(20 - T_1) = \cancel{K_V}\ \frac{\cancel{A}}{\cancel{L_3}}(T_2 - (-30))$$

$$20 - T_1 = T_2 + 30 \quad \ldots \text{ ec } 2$$

Remplazando

$$20 - T_1 = T_1(\alpha+1) - 20\alpha + 30$$

$$20 + 20\alpha - 30 = T_1(\alpha+1) + T_1$$

$$20\alpha - 10 = T_1(\alpha+2)$$

$$T_1 = \frac{20\alpha - 10}{\alpha+2}$$

Sabemos

$$\alpha = \frac{K_V}{K_A}\frac{L_2}{L_1} = \frac{0.8}{0.0234}\left(\frac{5}{4}\right)$$

$$\alpha = 42.74$$

Remplazando

$$T_1 = \frac{20(42.74) - 10}{42.74 + 2}$$

$$T_J = 18.9\ ^\circ C$$

Remplazando

$$H_J = K_V \frac{A}{L_J} (20 - 18.9)$$

$$H_J = 0.8 \frac{6}{4 \times 10^{-3}} (20 - 18.9)$$

$$H_J = 1320\ [W]$$

Gas Ideal

$$PV = nRT$$

R = constante del gas ideal $= 8.314 \frac{J}{mol\,^\circ K}$

$T = {}^\circ K$

Sabemos

$$PV = nRT$$

$$\frac{PV}{T} = ctte$$

Isocorico

$$V = ctte$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\boxed{\frac{P_1}{T_1} = \frac{P_2}{T_2}}$$

Isobarico

$P = ctte$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\boxed{\frac{V_1}{T_1} = \frac{V_2}{T_2}}$$

Isotermico

$T = ctte$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\boxed{P_1 V_1 = P_2 V_2}$$